# Infrastructure for Navigation of Interdisciplinary Debates

**Critical Decisions for Representing Argumentation**

A draft chapter prepared for the forthcoming book

***Visualizing Argumentation***

***Tools for Collaborative and Educational Sense-Making***

by
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## Differences among types of debates.

There are differences between those argumentation mapping schemes that focus on supporting real-time disputes and those which support carefully crafted, heavily edited representations of the intellectual history of some of humanity's most significant and enduring debates. Table 1. suggests some of the important distinctions:

| Debate Types | Audience | Purposes |
|---|---|---|
| **Real-time Debates** | Those currently involved in the debate | • capture debates and evaluations on the fly<br>• document a project's decisions<br>• support the development of the debate<br>• serve as a tool for teaching critical thinking |
| **Historical Debates** | Educators, researchers, students | • display the intellectual history of the debate as well as the current status<br>• provide a navigational framework for whole academic subfield<br>• serve as a tool for teaching critical thinking |

**TABLE 1. A comparison between real-time and historical debates**

Other chapters in this book describe approaches to the requirements for real-time debates. All of these approaches to argumentation analysis (historical and real-time) attempt to help people manage complexity and sort out differences of opinion and point of view.

**Critical decisions must be made before software is designed.**
This chapter will focus on the detailed sets of analytic and design decisions that need to be made to create effective argumentation maps on great debates, especially for use in teaching and learning. These are critical because once structure and graphic commitments are made, software is costly and difficult to change. I will organize our approach by showing how we solved a series of analysis and design problems that are relevant to any computer-assisted collaborative argumentation work.

## What level of detail?

Stephen Toulmin's pioneering book *The Uses of Argument* (Toulmin, 1957) was our inspiration. (1) (for a discussion see Shum chapter in this book) My initial impression was that he had solved all the problems. So I immediately attempted to use his diagrammatic approach (Toulmin et. al., 1979) with such public policy questions as the use of nuclear weapons (Horn, 1989, 200-203). But there was a major problem with the Toulmin approach: using it for a large, complicated argument created a huge tangle. It was fine for 5 to 10 sentences, but it became spaghetti for more. After experimentation we found that we were interested in portraying argumentation analysis at an overview level. Thus, argumentation mapping had at least two levels. There was the Toulmin level which worked the debate sentence by sentence. And there was a "higher" overview level of summary of the debate. It was this latter that we used in our first major project (described in case number one below).

**Preliminary assessment of overview approach**
Our preliminary assessment of the overview approach is that it is quite useful and that the next layer down in detail would be the actual words of the protagonist in the argument, either an excerpt or the complete article or chapter. In our web version, we plan to include such links to source material . Toulmin sentence-by-sentence analysis could also be included at a "deeper" level.

Little has been don by the Intellectual historians so far rather slow to use these argumentation methodologies. Instructors of history and philosophy of artificial intelligence and cognitive science have used the maps to a greater extent. (Horn 1998c, 2000)

## Case number one: *Mapping Great Debates: Can Computers Think?*

We wanted to do a major philosophical debate, one that would test the robustness of the overview level of argumentation analysis. I had the vision that it would be a contribution to our common intellectual heritage if we could "map" the great debates both current and

past. We picked the Turing debate as to whether computers will ever be able to think as a debate that both had a considerable history since 1950 and appeared to be ongoing. As we analyzed the large, sprawling debate—which turned out to have over 800 claims, rebuttals, and counter-rebuttals—we began to call what we were doing "argumentation mapping" because (as I shall discuss later) the graphic elements loomed large in display. (see Fig. 1 for an example of one of these 7 maps)

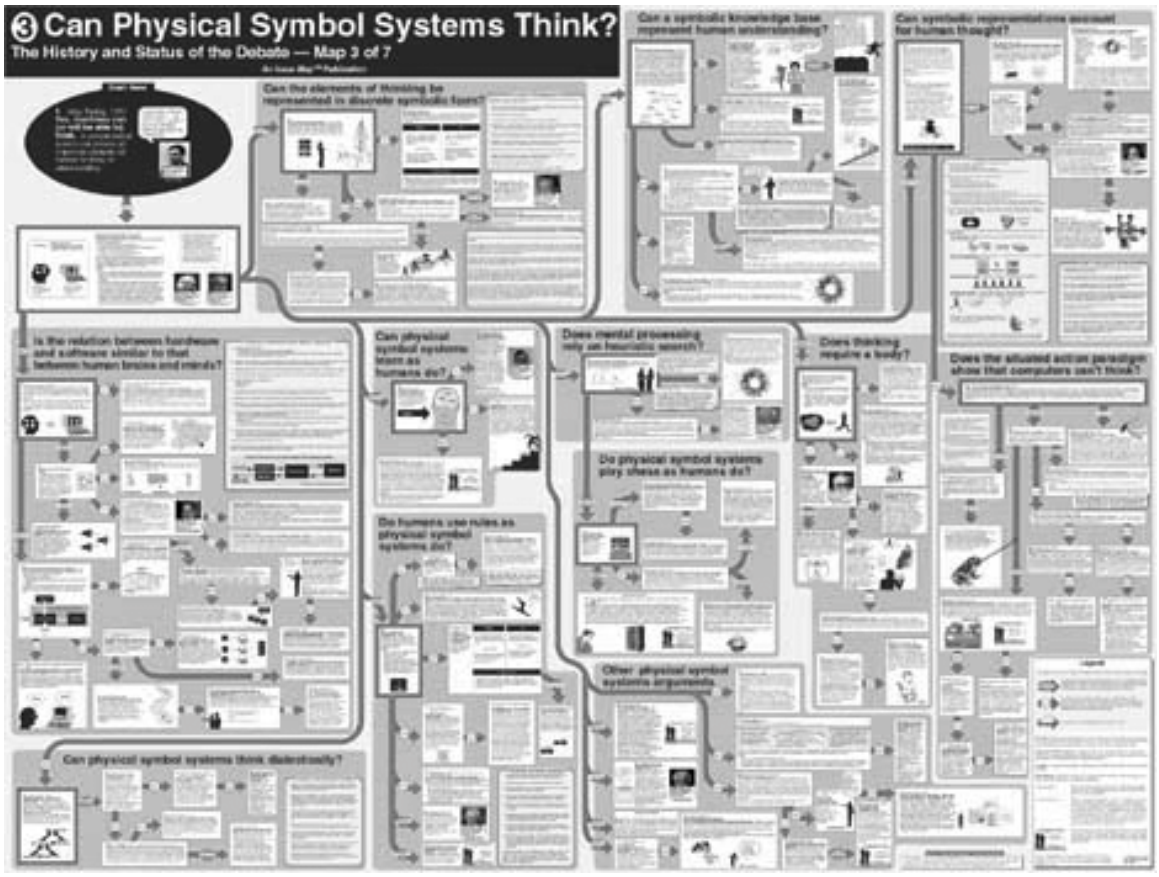


**FIGURE 1. This is one of seven maps in the Mapping Great Debates: Can Computers Think? Series.** **Reproduced by permission of MacroVU Press. www.macrovu.com**

## Claims, supports and disputes

To trace the threads of the arguments we crafted "claims boxes" that contained claims, rebuttals and counterrebuttals. We linked them with arrows that contained the words "is supported by" and "is disputed by." (see Fig.2 for a closeup of a thread of linkages.)

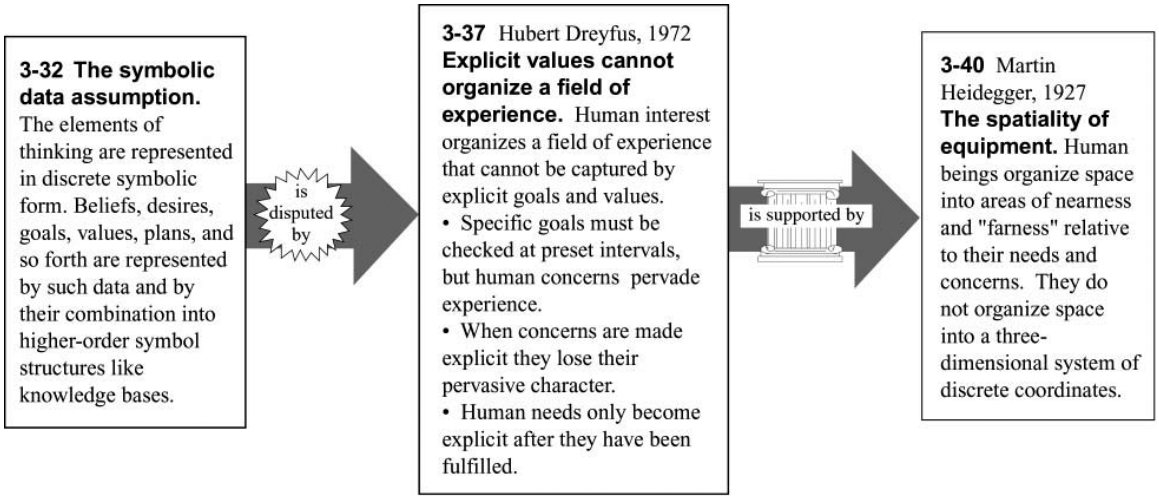
3-32 The symbolic data assumption. The elements of thinking are represented in discrete symbolic form. Beliefs, desires, goals, values, plans, and so forth are represented by such data and by their combination into higher-order symbol structures like knowledge bases.
is disputed by
3-37 Hubert Dreyfus, 1972 Explicit values cannot organize a field of experience. Human interest organizes a field of experience that cannot be captured by explicit goals and values.
• Specific goals must be checked at preset intervals, but human concerns pervade experience.
• When concerns are made explicit they lose their pervasive character.
• Human needs only become explicit after they have been fulfilled.
is supported by
3-40 Martin Heidegger, 1927 The spatiality of equipment. Human beings organize space into areas of nearness and "farness" relative to their needs and concerns. They do not organize space into a three-dimensional system of discrete coordinates.

**FIGURE 2. This is a closeup of one of the threads of arguments from the Mapping Great Debates series.** **Reproduced by permission of MacroVU Press.**
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## How to display both the history and the status of the debates at the same time.

We started out with the goal of showing the status of the debate. That part was relatively easy. All we had to do was read the current articles and see who was answering whom. But we were soon faced with the question of whether to show any current statement of previous claims and rebuttals or to find out who had made the claims first. So within the classification of argumentation analysis described at the beginning of this chapter, there are two criteria that need to be made clear. Criteria one: use the earliest statement of a "move" in the debate. This gives a new type of authentic intellectual history. Criteria two: use the best, or the only available, statement of a "move," which gives a rough-and-ready statement of the argument Both have value depending on your purposes. We chose the earliest-statement criteria so as to satisfy our own wish to provide intellectual history.

## Criteria for inclusion of "moves."

Over a considerable period of time, we developed criteria for the Mapping Great Debates series. Such criteria for inclusion and exclusion of moves are essential to the integrity of an argumentation map. Our final group:

***1. Use only published arguments.***

We decided to include only "moves" that were published in an established print or electronic medium: journals (including reputable electronic journals and white papers), magazines, and books. Arguments made in Usenet newsgroups, electronic forums, e-mail exchanges, or in interpersonal debate were excluded as too ephemeral and as representing positions still in development.

***2. Use only arguments that lie within the scope of the map.***

The major claim—that machines can or will be able to think—determines the scope of these maps. We excluded any threads of arguments that drifted away from the central

issue into such related territories as the mind–body problem, functionalism, and the philosophy of science.

***3. Seek out the historically earliest or best-known version of an argument.***
When different authors make similar arguments, we chose the version which was historically earliest. In a few cases, we used the best-known version of the argument. When the best-known version was used, the historically earliest version is usually mentioned in a note. In the few cases in which differing versions of an argument are sufficiently unique or separately disputed, each is summarized separately.

***4. Avoid loosely drawn arguments.***
Sometimes an author makes an argument loosely, at the end of a paragraph, as an aside, or in a footnote. In general, such arguments are not included unless they are developed further in follow-up articles or are the focus of further debate.

***5. Avoid repetitive, nitpicking, or duplicative arguments.***
One goal of the maps is to facilitate *productive* debate. *Ad hominem* arguments, redundant rounds of back-and-forth, and tediously nitpicky arguments were left out.

***6. Avoid forbiddingly technical discussion.***
There is a significant domain of highly technical arguments in logic and mathematics (mostly having to do with the Godel debates), which are based on extensive symbolic notation and formalisms, that could not be represented easily with the cartographic conventions we developed, or at the scale at which we chose to work. This was a difficult decision to make. I do not think that such highly mathematical arguments are in principle impossible to characterize in argumentation maps. However, it was difficult to map them within the limits of our paper poster format. Our compromise solution to this problem was to write *summaries* of many technical and symbolic discussions. Only the most forbidding (perhaps 2 or 3) had to be excluded entirely.

***7. Summarize the author's published claim.***
Many authors hold views today that are different from those they expressed at the time they entered into the debate. To be historically accurate, we included authors' claims *as published.* If an author later changed his or her position and published the change, the new claim was included, and the change of position was noted.

***8. Avoid tentative arguments.***
The tentative style of some academic writing often makes it extremely difficult to understand exactly what is being argued. Authors had to be definitive in their arguments to qualify for inclusion on the map.

***9. Include some rather ancient historical arguments.***
In order to properly situate the debate in its historical context, we included a sampling of notable historical philosophical supports for contemporary arguments such as arguments from Leibnitz and Descartes.

***10. Include some experimental results.***
To situate the debate in a context of concrete experimental and computational results, we included some implemented systems and empirical results. Again, we only included a small sample of such results, sticking to famous and notable computer models and experiments. See Figure 3 for an example.

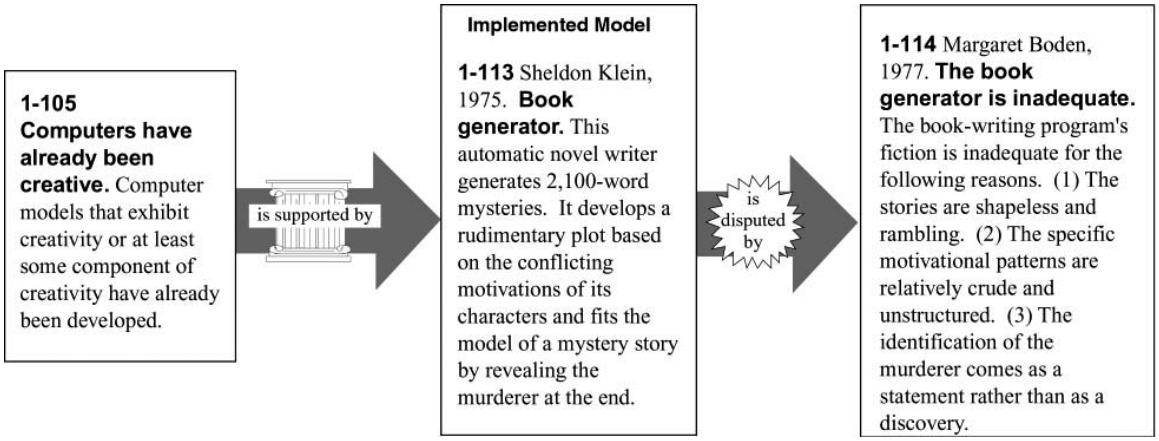

1-105 Computers have already been creative. Computer models that exhibit creativity or at least some component of creativity have already been developed.
is supported by
Implemented Model
1-113 Sheldon Klein, 1975. Book generator. This automatic novel writer generates 2,100-word mysteries. It develops a rudimentary plot based on the conflicting motivations of its characters and fits the model of a mystery story by revealing the murderer at the end.
is disputed by
1-114 Margaret Boden, 1977. The book generator is inadequate. The book-writing program's fiction is inadequate for the following reasons. (1) The stories are shapeless and rambling. (2) The specific motivational patterns are relatively crude and unstructured. (3) The identification of the murderer comes as a statement rather than as a discovery.

**FIGURE 3. This is an example of a claims box showing how claims about experimental results were used in argumentation maps. Reproduced by permission of MacroVU Press.** www.macrovu.com

***11. Include a small sample of outrageous and humorous arguments.***
Some of the stranger claims were worth including just to liven things up and have some fun. Such claims also provide potential "targets" for lively threads of response.

## How exactly to phrase arguments.

Claims can be written with great clarity or can be hopelessly confusing. We found that writers need to be continuously reminded to write the claims in simple declarative sentences. It is very easy for academic writers to hopelessly complicate sentences. This does not make for good argumentation mapping. Many is the time that our writers remarked that they wished that the debate protagonists whom they were summarizing would have written in such a succinct style.

## How to design large displays.

As it turned out, we decided to use paper posters for our initial display. Each of the seven posters measures 3 x 4 feet. Initially, we didn't know which method of spreading out the claims and rebuttals would be better for display. Our criteria here was: How easy is it the initial learner to "get into" the maps. We tested several versions. Top down? Bottom up? Center Outward? Which way should the arrows go: left-to-right or right-to-left?

Start-at-the-top and go-left-to-right appeared best. We tried several linking words and chose "is disputed by" and "is supported by" as our best option for clarity. These words effectively link the claims, supports, and dispute boxes, and also remind the reader of how to read the arrows.

Each of the seven maps present 100 or more major claims, rebuttals and counterrebuttals, each of which is summarized succinctly and placed in visual relationship to the other arguments that it supports or disputes. Claims are further divided into more than 70 issue areas, or major branches of the arguments, each organized around a question. (See figure 2) Arguments by nearly 400 cognitive scientists, philosophers, AI researchers, and mathematicians, and a half-dozen other specialties who have weighed into the argument in a significant way are represented on the maps.

This approach appears to continue to have value. We have built two conference rooms at Stanford University that have large wall-size computer-managed display screens. They are different from the usual projection devices in that every place on the wall has the resolution for approximately 10-point type. This resolution makes it possible to display large argumentation maps of the kind we have created. One early experiment with computer display showed the value of putting the maps on such screens.

The didactic opportunities abound. One can create software commands that say, "Show all of arguments by protagonist (x)." "Show the arguments in a single timeline instead of 70 issue-area timelines." "Show all of the arguments by protagonists from worldview (y)." These and many more computable variations will make the argumentation map a very flexible tool for educational situations. We hope to implement these in the near future.

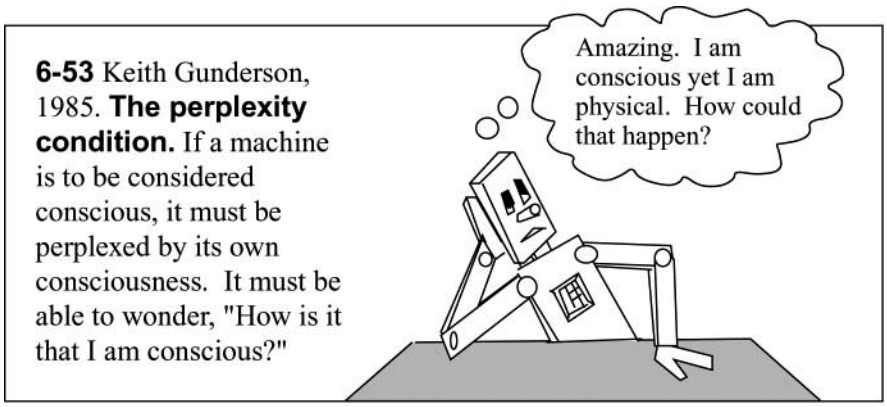
## How to graphically design the claims?

In extremely complex arguments, it is essential to use all the graphic tools available to clarify the debates and, thus, help the reader maneuver through the web of claims and rebuttals. The essential tool is a short title in boldface type for every claim and rebuttal. This improves initial scanning of the argument and also aids retracing one's steps through the debates. Earlier research (Horn, 1989, 1992, Hartley Trueman ( 1983) Reid &Wright, 1973) has shown that these kinds of subheads or titles provide "prechunking" that helps the reader overcome human shortcomings of working (or short-term) memory.

Our graphic approach is constructed on the syntactic and semantic analysis found in Horn 1998b. We used illustrations to (1) aid exposition of difficult topics (2) serve as examples (3) aid navigation. First, for some difficult topics, a diagram provides exceptional clarity and ease of understanding. Secondly, graphic illustrations that provide examples of the sometimes abstract and abstruse arguments give the reader welcome assistance. These graphics must be used if the maps are to achieve maximum usefulness to learners. Thirdly the rich use of visual icons, illustrations, and examples significantly aids readers' navigation of the argument. During the evaluation period, we frequently heard: "I remembered the drunken Norwegian argument's icon." "I could remember where the argument fit in and where to go back to find it."

It has become our practice to write the claims and rebuttals first, and then to add graphic illustrations. But one should not conclude from this sequence that the visuals are not tightly integrated with the verbal elements. Rather, this is simply a work process simplification, and often in this process, the verbal elements are modified to synchronize with the graphic elements.

In the final version of the *Can Computers Think?* maps, we used several hundred icons and illustrations and about 60 photographs. Figure 4 shows examples of some kinds of illustrations we used to enhance the claims boxes.


6-53 Keith Gunderson, 1985. The perplexity condition. If a machine is to be considered conscious, it must be perplexed by its own consciousness. It must be able to wonder, "How is it that I am conscious?"
Amazing. I am conscious yet I am physical. How could that happen?

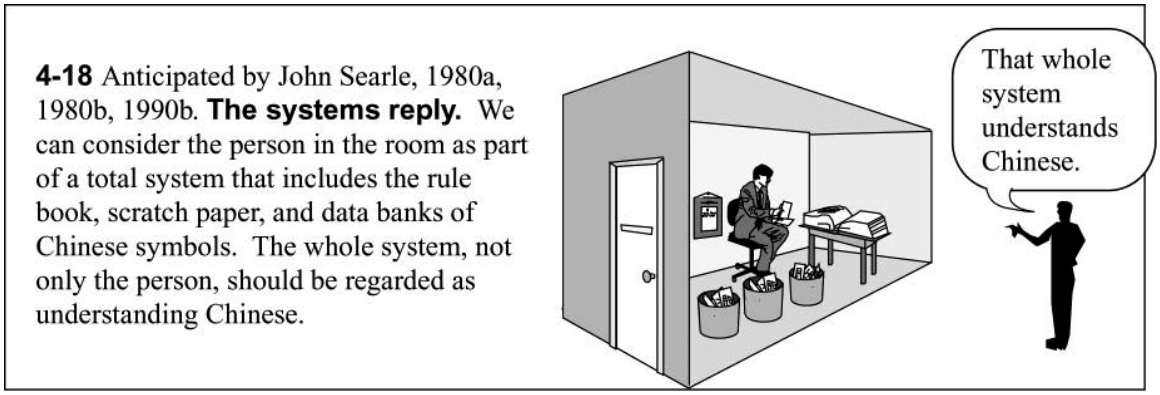

4-18 Anticipated by John Searle, 1980a, 1980b, 1990b. The systems reply. We can consider the person in the room as part of a total system that includes the rule book, scratch paper, and data banks of Chinese symbols. The whole system, not only the person, should be regarded as understanding Chinese.
That whole system understands Chinese.

**FIGURE 4. Examples of illustrated claims boxes from the Mapping Great Debates series.** **Reproduced by permission of MacroVU Press.** www.macrovu.com

## How to structure massive arguments?

An argument with 800 major moves defies most human ability to comprehend and manage. It became clear early in our process that the arguments clumped around themes. Our strategy was to let the data determine the clumps. That is, we worked from the bottom up rather than trying to impose a scheme of logically delineated themes.

At several points we found that there were references in the articles we were reading to "those who claim (x)" -- offered without citation. In fact it happened so often that we had threads of debates -- claims, rebuttals, counterrebuttals -- with no one to attribute the initial claim to. We finally assumed that much of the debate we were tracing was woven around conferences, meetings, and live debates where individuals asserted these major claims but no one bothered to put them in writing. Yet, for the linking together of arguments about a given theme, something more was needed. So we had to violate our "use only published sources" criterion to give the map regions sufficient coherence. At last, we invented what we call the "focus box" which was a statement of a claim for which we did not actually find a statement by some specific protagonist. These focus boxes were then used to initiate issue areas.

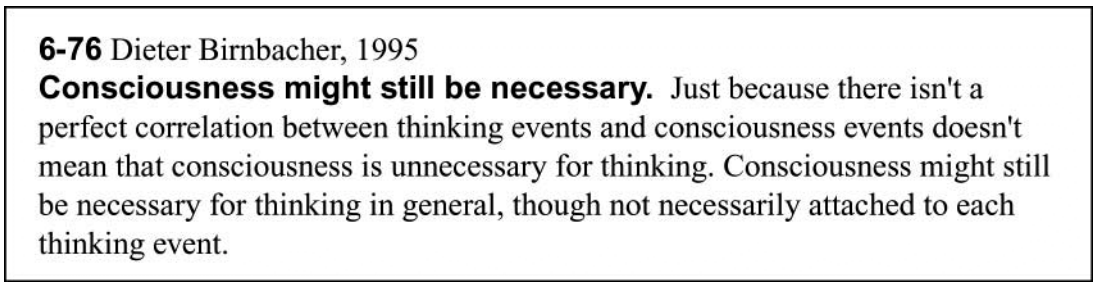

6-76 Dieter Birnbacher, 1995
Consciousness might still be necessary. Just because there isn't a perfect correlation between thinking events and consciousness events doesn't mean that consciousness is unnecessary for thinking. Consciousness might still be necessary for thinking in general, though not necessarily attached to each thinking event.

**FIGURE 5. Example of a focus box from the Mapping Great Debates series.**
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For several years during the time we were making these maps, we simply used words like "emotional arguments" or "creativity arguments" to clump the debates. As we began the final designs of the maps, it was suggested by a colleague that we translate the themes into questions to act as headlines for the regions (e.g. Can computers be creative? Can computers have emotions?). This has become our standard practice.

## How to represent and incorporate worldviews.

One of the difficult aspects of understanding great debates like this one is that the protagonists come from quite different points of view. They bring vastly different assumptions about the nature of reality. Often, in a specific article, the protagonists do not reveal their assumptions or their affiliation with a specific camp of thinkers. We have tried to provide a tool for learners here also. The basic clue was provided by Simon and Newell's listing of their postulates for the representationist point of view, which they call the physical symbol system hypothesis. (See Table 2) We then wrote sets of postulates for nine other major points of view and have included them on the various maps. We identified, where possible, which participants on the maps could be regarded as being part of a specific camp, thereby providing students with an insight as to why particular arguments might be taking place.

For us, it is still a research topic as to how to incorporate these postulates usefully onto web versions of the maps. It is also a creative project for our field to try to imagine a different sort of graphic display for worldviews than our lists of postulates.

## Postulates of the Physical Symbol Systems Hypothesis

1. A physical symbol system
   - is physical (that is, made up of some physical matter)
   - is a specific kind of system (that is, a set of components functioning through time in some definable manner) that manipulates instances of symbols.

2. Symbols can be thought of as elements that are connected and governed by a set of relations called a symbol structure. The physical instances of the elements (or tokens) are manipulated in the system.

3. An information process is any process that has symbol structures for at least some of its inputs or outputs.

4. An information processing system is a physical symbol system that consists of information processes.

5. Symbol structures are classified into
   - data structures
   - programs.

6. A program is a symbol structure that designates the sequence of information processes (including inputs and outputs) that will be executed by the elementary information processes of the processor.

7. Memory is the component of an information processing system that stores symbol structures.

8. Elementary information processes are transformations that a processor can perform upon symbol structures (e.g., comparing and determining equality, deleting, placing in memory, retrieving from memory, etc.).

9. A processor is a component of an information processing system that consists of:
   - a fixed set of elementary information processes,
   - a short-term memory that stores the input and output symbol structures of the elementary information processes, and
   - an interpreter that determines the sequence of elementary information processes to be executed as a function of the symbol structures in short-term memory.

10. The external environment of the system consists of "readable" stimuli. Reading consists of creating internal symbol structures in memory that designate external stimuli. Writing is the operation of emitting the responses to the external environment that are commanded by the internal symbol structures.

Adapted from Newell and Simon (1972, chap. 2).

Proponents include Jerry Fodor, Allen Newell, Herbert Simon, John McCarthy, Zenon Pylyshyn, early Marvin Minsky, Doug Lenat, Edward Feigenbaum, and Pat Hayes.

**TABLE 2. Example of Postulates.** **Reproduced by permission of MacroVU Press.**
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## How to incorporate ancillary information?

In developing the argumentation maps as a teaching and research tool, we recognized that the bare-bones, stand-alone argumentation map is insufficient. Students new to the area need supplementary information to enable them to fully comprehend the arguments. They need, for example, definitions and historical background. They need to have a Turing machine explained to them. We imbedded a variety of sidebars onto the maps to provide access to this information. The definitions have the visual look and feel of a dictionary entry. In the end, we included 50 definitions and 32 sidebars on the 7 maps. These are located at strategic spots in the maps close to where the topics and terms are introduced. As we have migrated some of the maps onto the web, these have become clickable topics. It is very important in developing such ancillary blocks of information to clearly label them by type (e.g. definitions, historical notes, etc.)

## How to incorporate secondary links?

We found, for example, that many of the arguments used for and against the von Neuman architecture (the kind of internal design of ordinary computers on our desks) and the arguments for and against connectionist networks (computers that are built around a structure similar to that of interlinked neurons) were quite analogous. Yet the arguments about connectionist architecture of computers took up half of map 5 and the sprawling arguments about von Neuman architecture covered maps 3 and 4. It seemed important to somehow show these similarities of argumentation threads to learners. There were other situations like this that appeared widely separated in the argumentation networks. We developed a set of secondary links which help readers tie together such important connections. On the paper versions, they were simple statements. For an example, see Figure 6. It is much easier to develop these secondary linkages in a software hypertext environment.

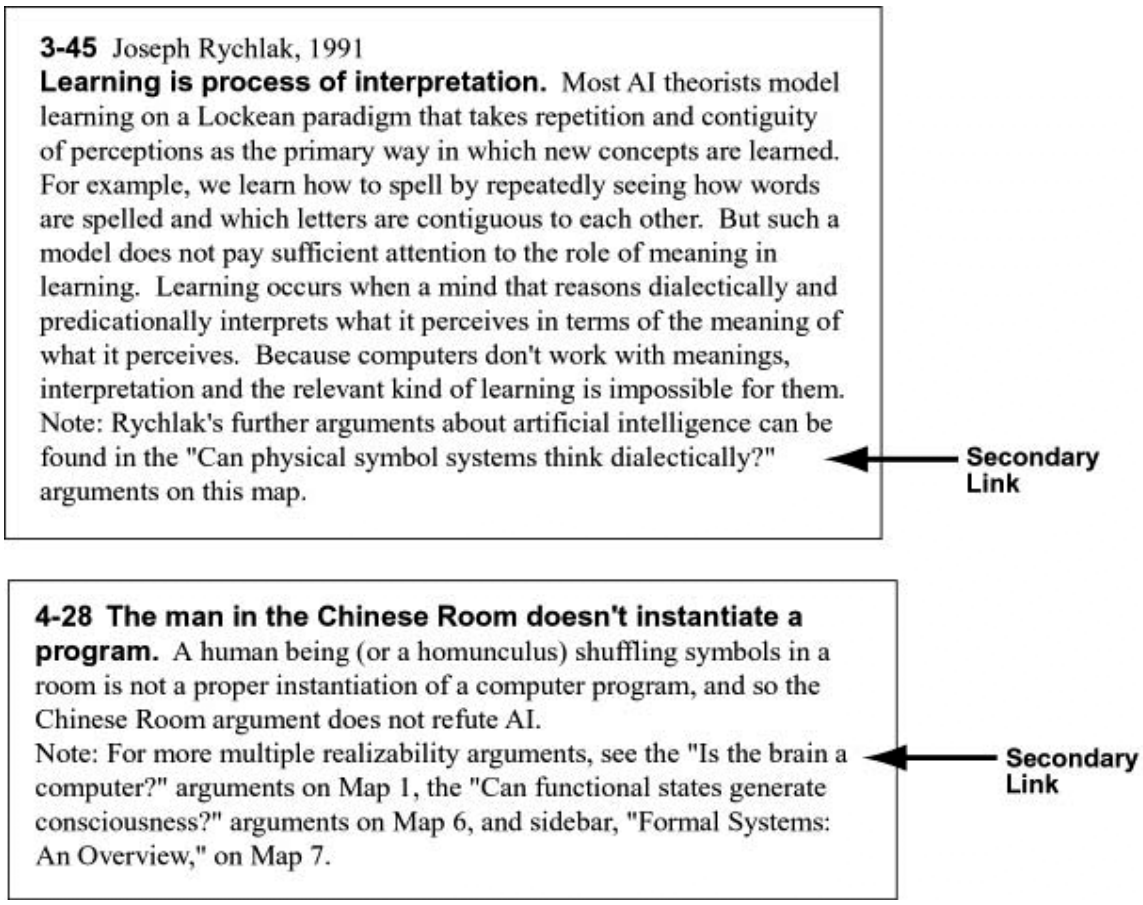
3-45 Joseph Rychlak, 1991
Learning is process of interpretation. Most AI theorists model learning on a Lockean paradigm that takes repetition and contiguity of perceptions as the primary way in which new concepts are learned. For example, we learn how to spell by repeatedly seeing how words are spelled and which letters are contiguous to each other. But such a model does not pay sufficient attention to the role of meaning in learning. Learning occurs when a mind that reasons dialectically and predicationally interprets what it perceives in terms of the meaning of what it perceives. Because computers don't work with meanings, interpretation and the relevant kind of learning is impossible for them.
Note: Rychlak's further arguments about artificial intelligence can be found in the "Can physical symbol systems think dialectically?" arguments on this map.
Secondary Link
4-28 The man in the Chinese Room doesn't instantiate a program. A human being (or a homunculus) shuffling symbols in a room is not a proper instantiation of a computer program, and so the Chinese Room argument does not refute AI.
Note: For more multiple realizability arguments, see the "Is the brain a computer?" arguments on Map 1, the "Can functional states generate consciousness?" arguments on Map 6, and sidebar, "Formal Systems: An Overview," on Map 7.
Secondary Link

**FIGURE 6. Examples of secondary links from the Mapping Great Debates series.** **Reproduced by permission of MacroVU Press.** www.macrovu.com

## What happens when there is a variation of a claim?

In some instances an author makes a distinctive and crucial shift in the definition of an issue, yet is clearly arguing with a specific protagonist. We had to indicate that a major shift in ground had taken place. When such a distinctive reconfiguration of an earlier claim was made, we used a different icon on the arrow with the words "is interpreted as." (See Figure 7 for an example)

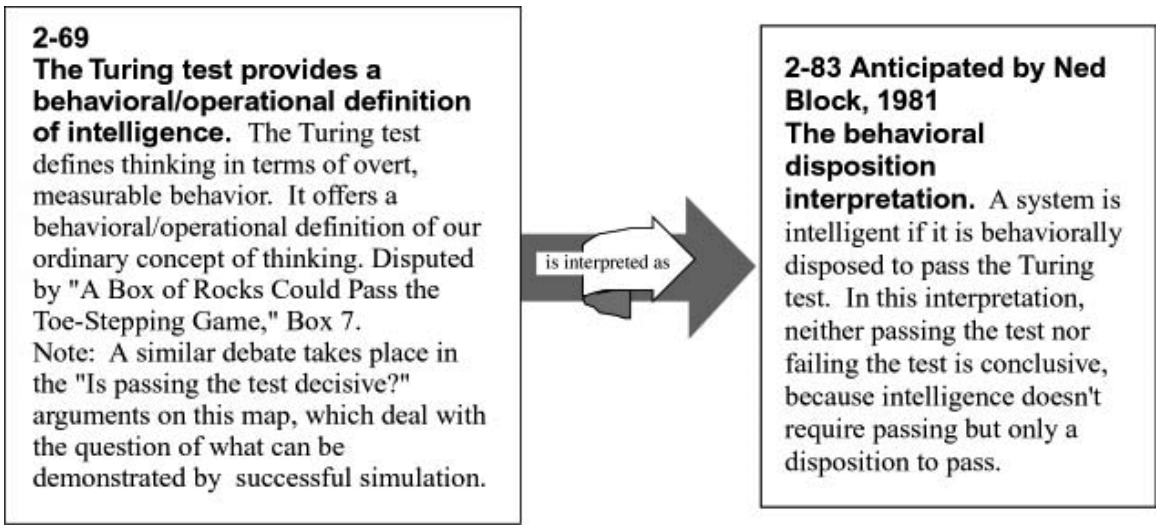
2-69
The Turing test provides a behavioral/operational definition of intelligence. The Turing test defines thinking in terms of overt, measurable behavior. It offers a behavioral/operational definition of our ordinary concept of thinking. Disputed by "A Box of Rocks Could Pass the Toe-Stepping Game," Box 7.
Note: A similar debate takes place in the "Is passing the test decisive?" arguments on this map, which deal with the question of what can be demonstrated by successful simulation.
is interpreted as
2-83 Anticipated by Ned Block, 1981
The behavioral disposition interpretation. A system is intelligent if it is behaviorally disposed to pass the Turing test. In this interpretation, neither passing the test nor failing the test is conclusive, because intelligence doesn't require passing but only a disposition to pass.

**FIGURE 7. Example of "is interpreted as" link from the Mapping Great Debates series.** **Reproduced by permission of MacroVU Press.** www.macrovu.com

## Value of CSCA in interdisciplinary navigation.

Our work on the *Mapping Great Debates: Can Computers Think?* series has opened up the development of a new field for the understanding of intellectual history. Among other advances, it illuminates the important history of how new concepts and distinctions in intellectual endeavors arise out of debate. Still to be worked out on the web-based versions are how to build instructional modules around the argumentation maps which would serve as the navigational core. However, the argumentation structure aids students, as well as researchers and scholars from outside a field, who, of course, become students once they enter an unfamiliar field.

## Pedagogical Implications

### Complexity requires structure

The argumentation maps are beginning to be used in a wide variety of ways in the classroom. It requires considerable rethinking for the instructor to change familiar classroom lecture and question routines to implement them to full use. But they offer the opportunity for innovative assignments ranging from (1.) ( relatively easy) choosing one of the 70 major branches of the debate and writing a paper agreeing or disagreeing, to (2.) (moderately more difficult) asking students to rank order the strength of different debates on a given branch and consider why they give the weights they do to the different arguments, to (3.) (more advanced) asking students to come up with at least one new argument at the end of one of the branches, which represent the frontiers of the debate, to (4.) (even more advanced) asking students to write a paper that shows why two or more of the eleven philosophical camps described in postulates on the maps are debating a particular issue.

One professor told me that he had always had difficulty explaining to graduate students about how to select and narrow down topics for philosophy dissertations. With the maps

he was able to show the amount and depth of coverage quite easily simply by waving his hands over parts of the maps.

**Opportunity to see major disagreements**

The biologist Lewis Thomas wrote, "College students, and for that matter high school students, should be exposed very early, perhaps at the outset, to the big arguments currently going on among scientists. Big arguments stimulate their interest, and with luck engage their absorbed attention... But the young students are told very little about the major disagreements of the day; they may be taught something about the arguments between Darwinians and their opponents a century ago, but they do not realize that similar disputes about other matters, many of them touching profound issues for our understanding of nature, are still going on, and, indeed are an essential feature of the scientific process." The maps provide major insights for the challenge that Thomas highlights. Over the next few years perhaps the biggest impact for teaching and learning from the use of argumentation maps will be in this area.

**Provide context and visible structure**

As we noted in Horn (2000): "We live in an age of information overload and specialization. The sheer numbers of argumentative "moves" in the maps(over 800); the number of authors represented on the maps (380); the number of sources that we consulted (over 1,000) and the sources that contained original arguments used in the maps (over 400) are overwhelming to the student undertaking study in this area.

One graduate student in the philosophy of mind said: "These maps would have saved me 500 hours of time my first year in graduate school. For almost two semesters, I had to keep reading article after article without enough context to see how they fit in to the bigger picture. The maps would have made my whole experience a much more rewarding one."

It was also interesting to hear from a professor of philosophy of mind who had begun using the maps in her teaching. She reported that "The maps have, in fact, prompted me to reorganize my Philosophy of Mind course to cover certain issues and problems from a particular approach, using the commentaries of thinkers noted on the maps--e.g. the Chinese Room in more depth, and connected more explicitly to the question 'Can Computers Think?'" (Wagner, 1998)

**Evaluations needed**

At this point, the evaluations of classroom use of our argumentation maps has been limited to observations by teachers and anecdotal feedback. The maps have been laminated and hung on walls in classrooms. They have been put in the library on reserve. They've been spread out on the seminar room table. A recurrent recommendation has been that they would be more frequently used if they were in some electronic form. But almost as soon as a professor suggests electronic form they take back the recommendation with the words "of course, then you wouldn't get the benefit of seeing the structure of the arguments that the maps provide." This can only be solved by larger screens.

# Case number two: Genetically modified food

## Science and science policy.

Society needs to be able to continuously evaluate new potentially disruptive knowledge and technologies. We were commissioned by *New Scientist* magazine to look into the question of how to create a web display of our maps on a science policy project. We were given the topic of the debates about genetically modified food and requested to investigate a prototype.

What was interesting was the arrangement of the top level--how the topic was "framed" by the questions asked. How the top level framing of the policy questions look on the web is shown in Figure 8.

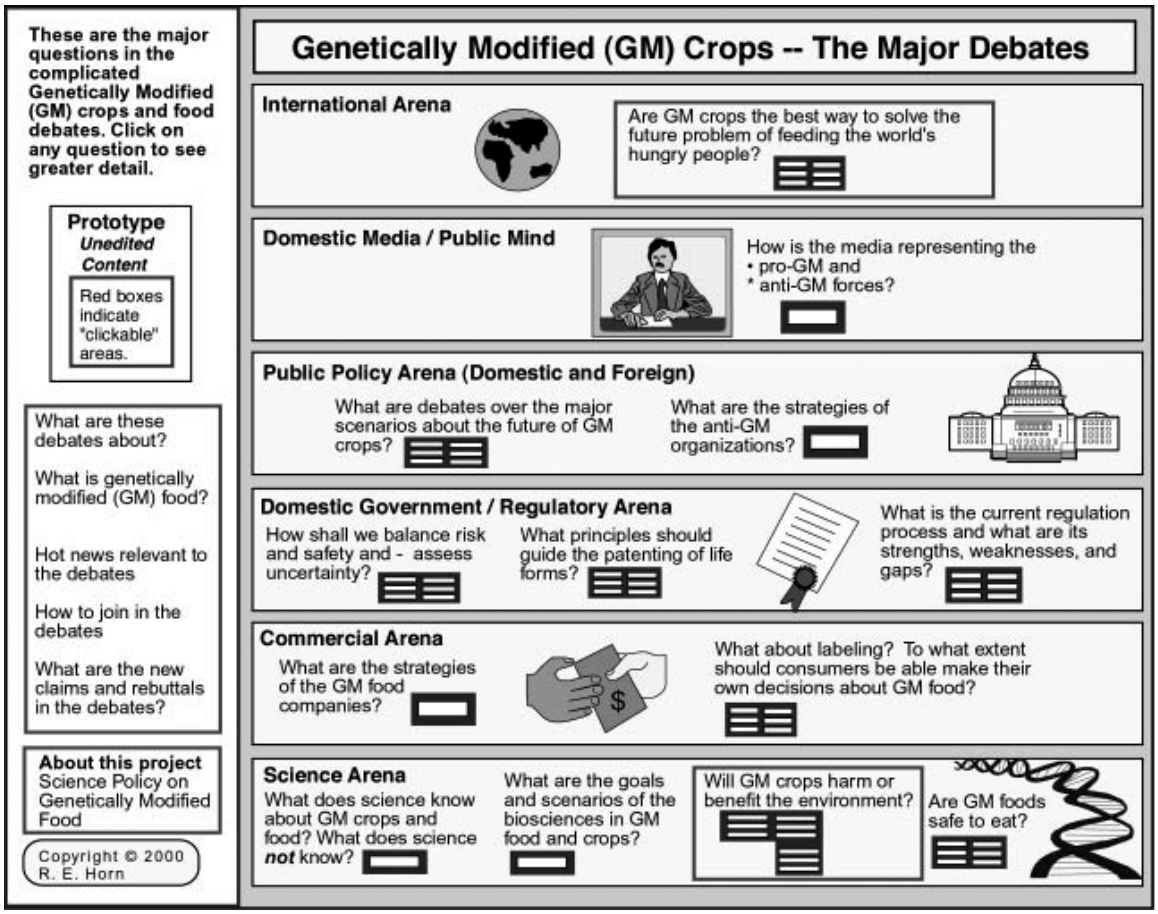
These are the major questions in the complicated Genetically Modified (GM) crops and food debates. Click on any question to see greater detail.
Prototype
Unedited Content
Red boxes indicate "clickable" areas.
What are these debates about?
What is genetically modified (GM) food?
Hot news relevant to the debates
How to join in the debates
What are the new claims and rebuttals in the debates?
About this project
Science Policy on Genetically Modified Food
Copyright © 2000 R. E. Horn
Genetically Modified (GM) Crops -- The Major Debates
International Arena
Are GM crops the best way to solve the future problem of feeding the world's hungry people?
Domestic Media / Public Mind
How is the media representing the
• pro-GM and
* anti-GM forces?
Public Policy Arena (Domestic and Foreign)
What are debates over the major scenarios about the future of GM crops?
What are the strategies of the anti-GM organizations?
Domestic Government / Regulatory Arena
How shall we balance risk and safety and - assess uncertainty?
What principles should guide the patenting of life forms?
What is the current regulation process and what are its strengths, weaknesses, and gaps?
Commercial Arena
What are the strategies of the GM food companies?
What about labeling? To what extent should consumers be able make their own decisions about GM food?
Science Arena
What does science know about GM crops and food? What does science not know?
What are the goals and scenarios of the biosciences in GM food and crops?
Will GM crops harm or benefit the environment?
Are GM foods safe to eat?

**FIGURE 8. The top level window of the Mapping Great Debates series on Genetically Modified Food.** Reproduced by permission of the project director, R.E. Horn.

## How to display extensive argumentation on the web?

Displaying extensive argumentation on the web within the confines of small screens is difficult. Initially we tried simply to put our maps on the web as they were presented in print format. But debates of more than a few moves produced much difficulty for the reader to stay oriented. Once into the middle of the visual space, the reader had difficulty tracing the arguments back. As this chapter goes to press, we are experimenting with a vertical format illustrated in Figure 9.

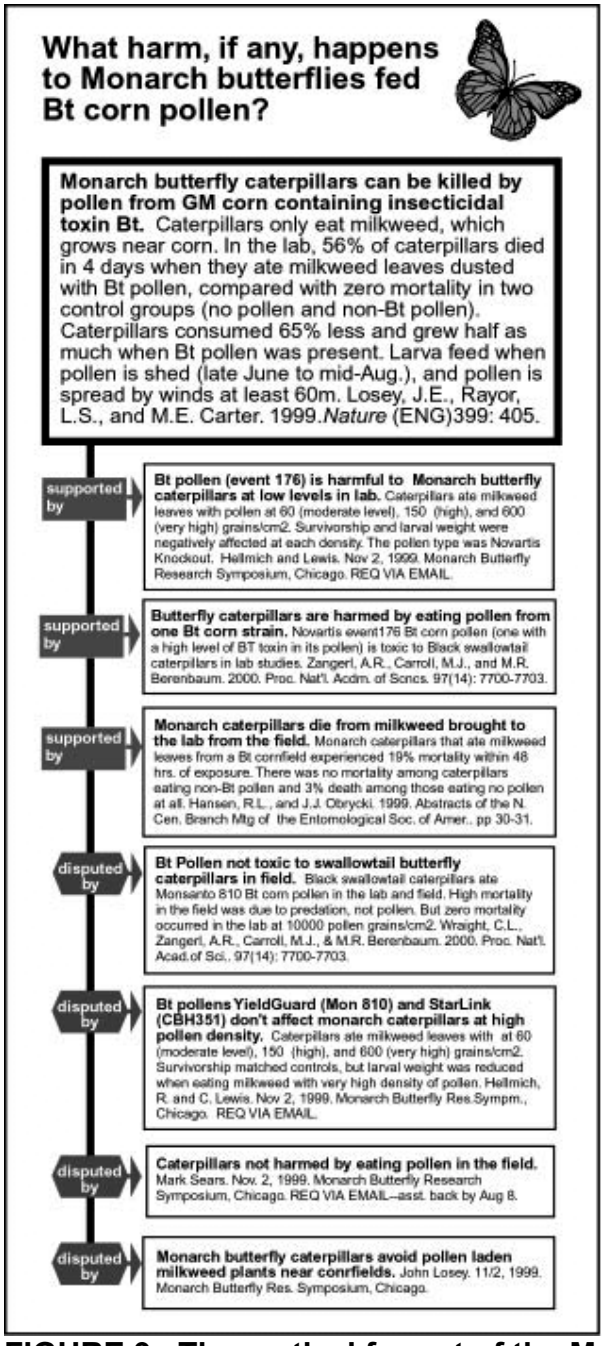
What harm, if any, happens to Monarch butterflies fed Bt corn pollen?
Monarch butterfly caterpillars can be killed by pollen from GM corn containing insecticidal toxin Bt. Caterpillars only eat milkweed, which grows near corn. In the lab, 56% of caterpillars died in 4 days when they ate milkweed leaves dusted with Bt pollen, compared with zero mortality in two control groups (no pollen and non-Bt pollen). Caterpillars consumed 65% less and grew half as much when Bt pollen was present. Larva feed when pollen is shed (late June to mid-Aug.), and pollen is spread by winds at least 60m. Losey, J.E., Rayor, L.S., and M.E. Carter. 1999. Nature (ENG)399: 405.
supported by
Bt pollen (event 176) is harmful to Monarch butterfly caterpillars at low levels in lab. Caterpillars ate milkweed leaves with pollen at 60 (moderate level), 150 (high), and 600 (very high) grains/cm2. Survivorship and larval weight were negatively affected at each density. The pollen type was Novartis Knockout. Hellmich and Lewis. Nov 2, 1999. Monarch Butterfly Research Symposium, Chicago. REQ VIA EMAIL.
supported by
Butterfly caterpillars are harmed by eating pollen from one Bt corn strain. Novartis event176 Bt corn pollen (one with a high level of BT toxin in its pollen) is toxic to Black swallowtail caterpillars in lab studies. Zangerl, A.R., Carroll, M.J., and M.R. Berenbaum. 2000. Proc. Nat'l. Acdm. of Sncs. 97(14): 7700-7703.
supported by
Monarch caterpillars die from milkweed brought to the lab from the field. Monarch caterpillars that ate milkweed leaves from a Bt cornfield experienced 19% mortality within 48 hrs. of exposure. There was no mortality among caterpillars eating non-Bt pollen and 3% death among those eating no pollen at all. Hansen, R.L., and J.J. Obrycki. 1999. Abstracts of the N. Cen. Branch Mtg of the Entomological Soc. of Amer., pp 30-31.
disputed by
Bt Pollen not toxic to swallowtail butterfly caterpillars in field. Black swallowtail caterpillars ate Monsanto 810 Bt corn pollen in the lab and field. High mortality in the field was due to predation, not pollen. But zero mortality occurred in the lab at 10000 pollen grains/cm2. Wraight, C.L., Zangerl, A.R., Carroll, M.J., & M.R. Berenbaum. 2000. Proc. Nat'l. Acad.of Sci., 97(14): 7700-7703.
disputed by
Bt pollens YieldGuard (Mon 810) and StarLink (CBH351) don't affect monarch caterpillars at high pollen density. Caterpillars ate milkweed leaves with at 60 (moderate level), 150 (high), and 600 (very high) grains/cm2. Survivorship matched controls, but larval weight was reduced when eating milkweed with very high density of pollen. Hellmich, R. and C. Lewis. Nov 2, 1999. Monarch Butterfly Res.Sympm., Chicago. REQ VIA EMAIL.
disputed by
Caterpillars not harmed by eating pollen in the field. Mark Sears. Nov. 2, 1999. Monarch Butterfly Research Symposium, Chicago. REQ VIA EMAIL--asst. back by Aug 8.
disputed by
Monarch butterfly caterpillars avoid pollen laden milkweed plants near conrfields. John Losey. 11/2, 1999. Monarch Butterfly Res. Symposium, Chicago.

**FIGURE 9. The vertical format of the Mapping Great Debates series on Genetically Modified Food.** **Reproduced by permission of the project director, R.E. Horn.**

The genetically modified food project did not receive any formal evaluation as it was done as a prototype project. We are in the process of seeking support to evaluate its use in public policy development.

# Case number three: Consciousness research

## How to display different entry points?

We received a grant several years ago to create prototype argumentation maps in the rapidly expanding discipline of consciousness studies. This presents a different problem from that of the Turing debates. The debates are all focused on the same phenomena -- consciousness -- but different disciplines start with quite different questions. What this has meant for mapping the debate is that there can not be a single determining question, such as appears in the Turing debates (i.e. Can Computers Think?) So, we have provisionally decided to simply cluster questions. Our first group of questions are the philosophical ones, and as a top-level web page can be seen in Figure 10. Part of our detailed argumentation map is shown in Figure 11.

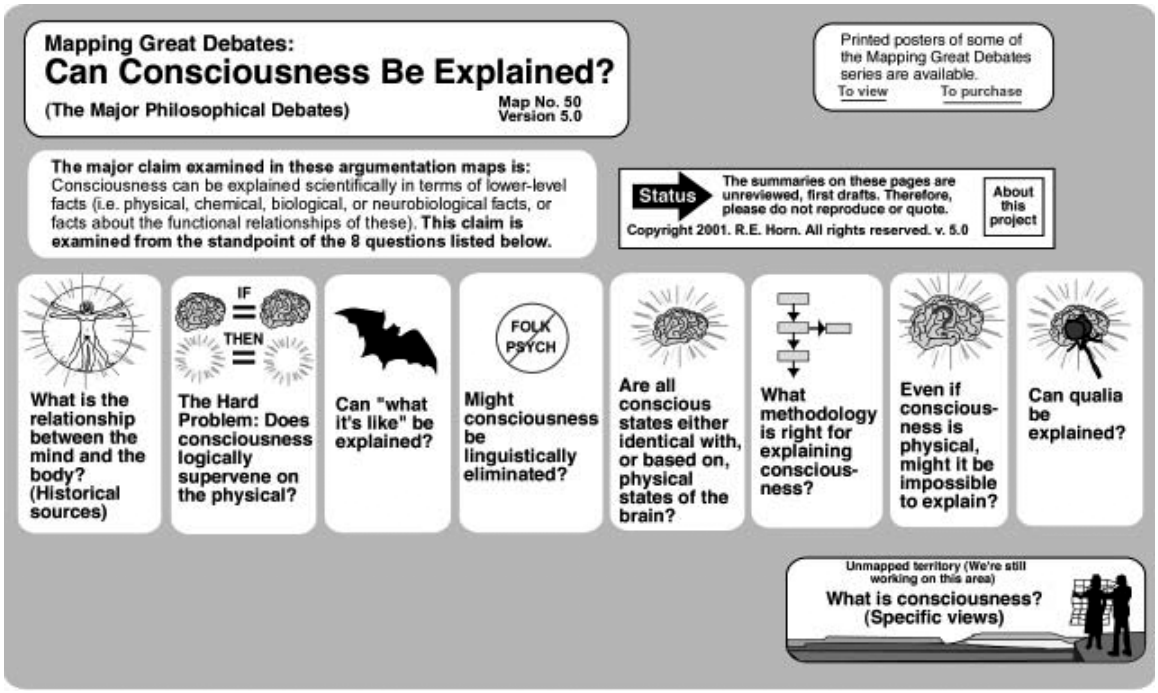
Mapping Great Debates:
Can Consciousness Be Explained?
(The Major Philosophical Debates)
Map No. 50
Version 5.0
Printed posters of some of the Mapping Great Debates series are available.
To view
To purchase
The major claim examined in these argumentation maps is:
Consciousness can be explained scientifically in terms of lower-level facts (i.e. physical, chemical, biological, or neurobiological facts, or facts about the functional relationships of these). This claim is examined from the standpoint of the 8 questions listed below.
Status
The summaries on these pages are unreviewed, first drafts. Therefore, please do not reproduce or quote.
Copyright 2001. R.E. Horn. All rights reserved. v. 5.0
About this project
What is the relationship between the mind and the body? (Historical sources)
IF
THEN
The Hard Problem: Does consciousness logically supervene on the physical?
Can "what it's like" be explained?
FOLK PSYCH
Might consciousness be linguistically eliminated?
Are all conscious states either identical with, or based on, physical states of the brain?
What methodology is right for explaining consciousness?
Even if consciousness is physical, might it be impossible to explain?
Can qualia be explained?
Unmapped territory (We're still working on this area)
What is consciousness? (Specific views)

**FIGURE 10. The top level of the Mapping Great Debates series on Consciousness.** **Reproduced by permission of the project director, R.E. Horn.**

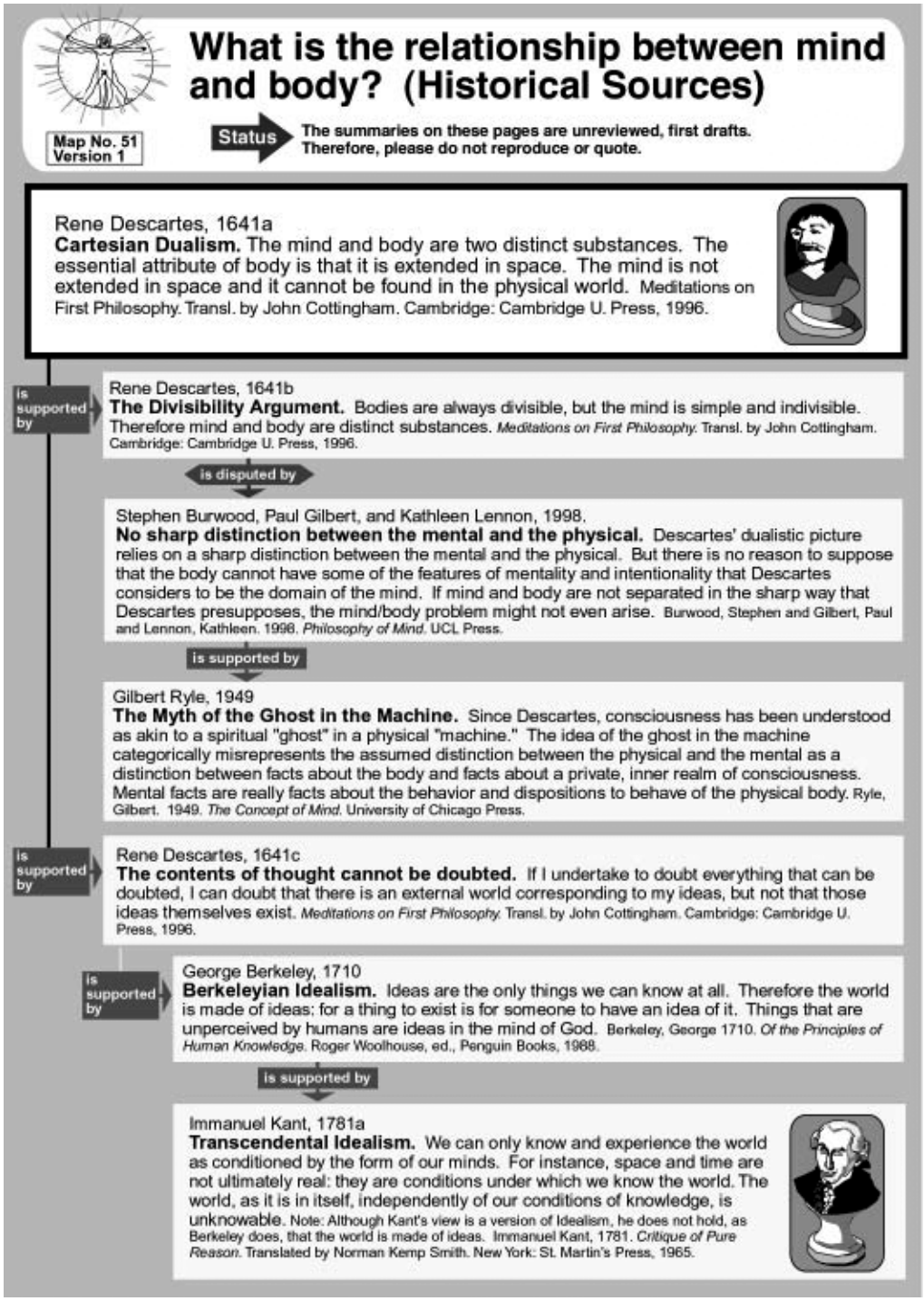
What is the relationship between mind and body? (Historical Sources)
Map No. 51
Version 1
Status
The summaries on these pages are unreviewed, first drafts. Therefore, please do not reproduce or quote.
Rene Descartes, 1641a
Cartesian Dualism. The mind and body are two distinct substances. The essential attribute of body is that it is extended in space. The mind is not extended in space and it cannot be found in the physical world. Meditations on First Philosophy. Transl. by John Cottingham. Cambridge: Cambridge U. Press, 1996.
is supported by
Rene Descartes, 1641b
The Divisibility Argument. Bodies are always divisible, but the mind is simple and indivisible. Therefore mind and body are distinct substances. Meditations on First Philosophy. Transl. by John Cottingham. Cambridge: Cambridge U. Press, 1996.
is disputed by
Stephen Burwood, Paul Gilbert, and Kathleen Lennon, 1998.
No sharp distinction between the mental and the physical. Descartes' dualistic picture relies on a sharp distinction between the mental and the physical. But there is no reason to suppose that the body cannot have some of the features of mentality and intentionality that Descartes considers to be the domain of the mind. If mind and body are not separated in the sharp way that Descartes presupposes, the mind/body problem might not even arise. Burwood, Stephen and Gilbert, Paul and Lennon, Kathleen. 1998. Philosophy of Mind. UCL Press.
is supported by
Gilbert Ryle, 1949
The Myth of the Ghost in the Machine. Since Descartes, consciousness has been understood as akin to a spiritual "ghost" in a physical "machine." The idea of the ghost in the machine categorically misrepresents the assumed distinction between the physical and the mental as a distinction between facts about the body and facts about a private, inner realm of consciousness. Mental facts are really facts about the behavior and dispositions to behave of the physical body. Ryle, Gilbert. 1949. The Concept of Mind. University of Chicago Press.
is supported by
Rene Descartes, 1641c
The contents of thought cannot be doubted. If I undertake to doubt everything that can be doubted, I can doubt that there is an external world corresponding to my ideas, but not that those ideas themselves exist. Meditations on First Philosophy. Transl. by John Cottingham. Cambridge: Cambridge U. Press, 1996.
is supported by
George Berkeley, 1710
Berkeleyian Idealism. Ideas are the only things we can know at all. Therefore the world is made of ideas: for a thing to exist is for someone to have an idea of it. Things that are unperceived by humans are ideas in the mind of God. Berkeley, George 1710. Of the Principles of Human Knowledge. Roger Woolhouse, ed., Penguin Books, 1988.
is supported by
Immanuel Kant, 1781a
Transcendental Idealism. We can only know and experience the world as conditioned by the form of our minds. For instance, space and time are not ultimately real: they are conditions under which we know the world. The world, as it is in itself, independently of our conditions of knowledge, is unknowable. Note: Although Kant's view is a version of Idealism, he does not hold, as Berkeley does, that the world is made of ideas. Immanuel Kant, 1781. Critique of Pure Reason. Translated by Norman Kemp Smith. New York: St. Martin's Press, 1965.

**FIGURE 11. The vertical format of the Mapping Great Debates series on CONSCIOUSNESS.** **Reproduced by permission of the project director, R.E. Horn.**

It is clear that questions emanating from neuropsychology will start from quite different places.

### How to build infrastructure collaboratively?

As this chapter is written, we have begun to work on the issue of how to involve graduate students in collaboratively creating maps. Clearly there needs to be a course to help bring students into the conventions and criteria used in the mapping. In addition we need to provide some kind of content and editorial review of their summaries of moves. We are not interested in developing a chatroom. The content review needs to be done by specialists. The editorial review needs to be of two kinds: the writing of the actual sentences summarizing claims, and the linkages. How this will all be managed on the web is yet another research problem. We imagine using some form of annotation functionality in the software.

## Conclusion: Our vision

We envision the ability over time to witness the creation of vast webs of argumentation maps on the web that cover many fields and that show us how humanity working together has asked, debated, and sometimes even answered the Great Questions.

## Acknowledgements

I want to salute the members of my team--Jeff Yoshimi, Mark Deering, (University of California, Irvine) and Russ McBride (University of California, Berkeley)—without whose dedicated effort and creative thought these maps would not be what they are today. I also want to thank the publishers, MacroVU, Inc. and the Lexington Institute, for their generous support of the Can Computers Think? project. I further salute Paul Livingston as the primary writer in our project on consciousness. I further want to thank The Consciousness Studies Program of Arizona University for support (through a grant from the Fetzer Institute) of the Consciousness Project. And finally, I want to express appreciation to *New Scientist* magazine (especially its editor, Alan Anderson) for support of the Genetically Modified Food project, and to project analysts Ben Shouse and Shirley Dang.

## Notes

1. Our project began in the mid-80s. The work I had done on the Information Mapping (1) method of structured writing and analysis is a successful attempt to carefully delineate a taxonomy and later a life-cycle document-creation methodology for relatively stable subject matter. (Horn, 1989, 1992a , 1992b, 1993, 1995) Relatively stable subject matter is that which doesn't change much and about which there is little dispute. Information Mapping's method is widely used in industry and government for writing documentation, training, procedures and policies, and reports. Information Mapping is a registered trademark of Information Mapping, Inc. see <www.informap.com>

# References


Hartley, J. and Trueman, M., ( 1983) The Effects of Headings in Text on Recall, Search and Retrieval, *British Jounral of Educational Psychology,* 53, 205-214

Horn, R. E. (1989) *Mapping Hypertext,* Lexington MA, The Lexington Institute

Horn, R. E. (1992a) *How High Can it Fly Examining the Evidence on Information Mapping's Method of High Performance Communication,,* Lexington MA, The Lexington Institute

Horn, R. E. (1992b) Clarifying Two Controversies About Information Mapping's Method, *Educational and Training Technology International,* 2, 29, 109 - 117

Horn, R. E., Structured Writing at Twenty Five (1993) *Performance and Instruction,* February 1993, 11-17

Horn, R. E., Structured Writing as a Paradigm, (1995) in Alexander Romiszowski and Charles Dills (eds) *Instructional Development: State of the Art* edited by , Englewood Cliffs, N. J., Educational Technology Publications

Horn, R. E. (1998a) *Mapping Great Debates: Can Computers Think?* A series of seven maps and Handbook. MacroVU, Inc. Bainbridge Island, WA. (Publisher's website <www.macrovu.com>

Horn, R. E. (1998b) *Visual Language: Global Communication for the 21st Century.* MacroVU, Inc. Bainbridge Island, WA.

Horn, R. E. (1998c) Using Argumentation Analysis to Examine History and Status of a Major Debate in Artificial Intelligence and Philosophy in van Eemeren, F. H, Grootendorst, R., Blair, J.A., and Willard, C. A. (eds) *Proceedings of the Fourth International Conference of the International Society for Study of Argumentation,* June 16-19, 1998, 375-381

Horn, R. E. (2000) Teaching Philosophy with Argumentation Maps, *American Philosophical Association Newsletter on Teaching Philosophy,* Fall 2000, 153-159

Reid, F, and Wright, P. (1973) Written Information: Some Alternatives to Prose for Expressing the Outcomes of Complex Contingencies, *Journal of Applied Psychology,* 57, 2, 160-166

Thomas, L. (1981). Debating the Unknowable. *Atlantic Monthly*, July, 49-50.

Toulmin, S. (1958). *The Uses of Argument,* Cambridge: Cambridge University Press.

Toulmin, S, Rieke, R., and Janik, A. (1979) *An Introduction to Reasoning*, New York, Macmillan

Turing, A. (1950). Computing machinery and intelligence. *Mind* 59, 434-460.

Wagner, E. (1998) Personal communication. Full text available at http://www.macrovu.com